PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-316836

(43)Date of publication of application : 16.11.1999

(51)Int.Cl.	G06T 7/00

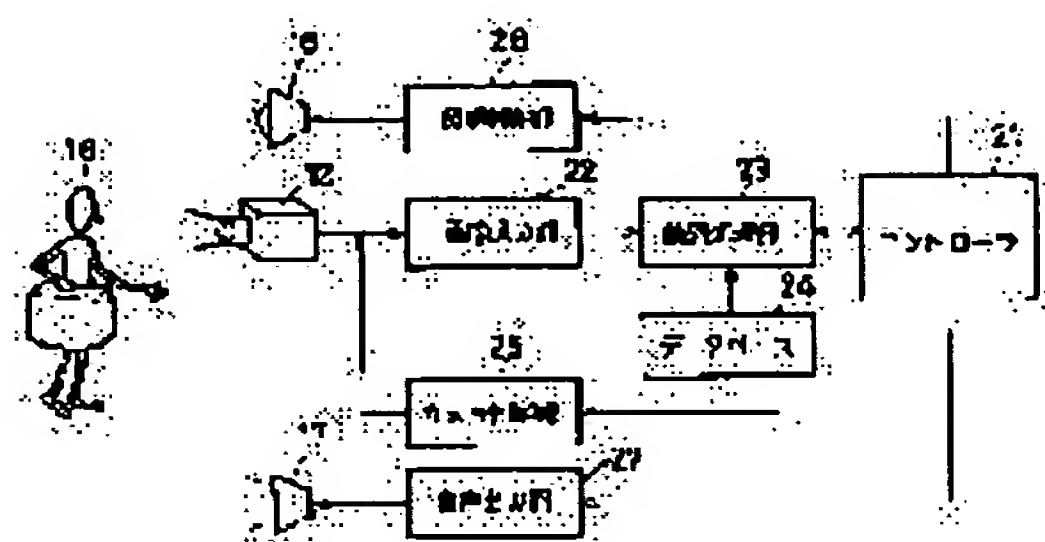|	
(21)Application number : 10-123231	(71)Applicant : OMRON CORP
(22)Date of filing : 06.05.1998	(72)Inventor : SOGO KOJI

(54) PERSON IDENTIFYING

(57)Abstract:

PROBLEM TO BE SOLVED: To surely identify a specified person at the time of performing re- identification processing, accompanying the specification of a person oneself by providing an image re-acquisition condition changing means to change image re-acquisition result of physical characteristics from those at the last time when acquiring a re-image by means of an image acquiring means.

SOLUTION: When an image is acquired from an image pickup camera 12, the characteristic quantity of an image acquired by an identification processing part 23 is compared with the characteristic quantity proper to a specified person 18 stored and managed by a database 24 and collation is confirmed. When it is decided that the person can not be correctly identified from the acquired image, an acquisition condition of physical characteristic quantity is significantly changed by controlling at least one from a controller 21 and an image acquisition data is made different from the last one and is acquired through this. Thus, an acquired image is surely different this time from the last time, the preceding image acquisition condition itself in which an identification element is in short is improved and the physical characteristic quantity of the person 18 can be clearly acquired.

LEGAL STATUS

[Date of request for examination]	14.02.2002
[Date of sending the examiner's decision of rejection]	
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3580129
[Date of registration]	30.07.2004
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

CLAIMS

[Claim(s)]
[Claim 1] him who specifies him from similarity with the amount of the specific person who specified beforehand of bodily features which acquires people's amount of bodily features from an image acquisition means, and this amount of bodily features that acquired, and a storage means memorize — him who is specific equipment and had a re-image acquisition condition modification means for changing the re-image acquisition result of the amount of bodily features with last time at the time of re-image acquisition of the above-mentioned image acquisition means — specific equipment.
[Claim 2] him who specifies him from similarity with the face image of the specific person who specified beforehand which acquires people's face image from an image acquisition means, and this face image that acquired, and a storage means memorize — him who is specific equipment and had a re-image acquisition condition modification means for changing the re-image acquisition result of a face image with last time at the time of re-image acquisition of the above-mentioned image acquisition means — specific equipment.
[Claim 3] A re-image acquisition condition modification means is he specification equipment according to claim 1 or 2 characterized by being the lighting control means which carries out modification control of the quantity of light.
[Claim 4] A re-image acquisition condition modification means is he specification equipment according to claim 1 or 2 characterized by being the exposure-time control means which carries out modification control of the exposure time of an image acquisition means.
[Claim 5] A re-image acquisition condition modification means is he specification equipment according to claim 1, 2, or 3 characterized by being the migration adjustment control means which carries out migration adjustment of at least one of a lighting control means and the image acquisition means.
[Claim 6] the conduct into which a re-image acquisition condition modification means makes the expression of a face, and people's sense changed — the he specification equipment according to claim 1 or 2 characterized by having an action guidance means.
[Claim 7] A re-image acquisition condition modification means is he specification equipment according to claim 1 or 2 had a presumed means to presume the image acquisition conditions that a modification element is most effectively obtained out of the image acquisition conditions used as the specific unknown cause that he cannot be specified, and the modification control means carry out modification control to the image acquisition conditions presumed with the above-mentioned presumed means.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] him who this invention uses people's amount of bodily features for a collating element, and identifies — him who raised the specific success percentage at the time of the re-specification processing repeatedly performed about specific equipment at the time of the specific impossible which cannot identify him correctly [it is still more detailed and] at once — it is related with specific equipment.
[0002]
[Description of the Prior Art] general — this kind of him — specific equipment photos the face of those who walk with an image pick-up camera, and this is identified on real time or it has the discernment function to photo and identify those who have stopped in front of the device. It is identifying whether you are him by extracting characteristic quantity from a face image, comparing this characteristic quantity and registration data that were extracted on the occasion of this discernment, and asking for similarity.
[0003] When he is not correctly discriminable at this time, a discernment procedure is repeated and re-discernment processing is performed. In this case, if the probability to identify him correctly by one discernment processing has 90% of discernment success percentage, it will be set to 1-(1-0.9) N, for example, discernment success percentage will become 99.99% also as a count N= 3 of re-discernment processing. Thus, even if the discernment success percentage per time is low, if the count of re-discernment processing is increased, on count, discernment success percentage will improve sharply.
[0004] However, though the discernment processing image which is not successful even if it will carry out what times loop, if it is the image with the discernment processing image of re-discernment processing completely same in practice and it becomes an error at the 1st time, and is re-identified similarly compares and several frames differ in time, even if there is no big difference visually to a face image and it carries out repetition re-discernment processing, it does not succeed in many cases. The brightness of an input image is not suitable especially, shading of a face image is not superfluous, the result which may be re-identified what times when the sense of a face is unsuitable for discernment is not obtained, but it becomes a discernment error in many cases.
[0005]
[Problem(s) to be Solved by the Invention] then, him who makes a setting change of this invention at the image acquisition conditions that it was suitable for this re-discernment processing when carrying out re-discernment processing with his specification, and enabled it to identify a specific person certainly — it aims at offer of specific equipment.
[0006]
[Means for Solving the Problem] Invention according to claim 1 acquires people's amount of bodily features from an image acquisition means. It is specific equipment. him who specifies him from similarity with the amount of bodily features of the specific person who specified beforehand which this acquired amount of bodily features and a storage means memorize — It is characterized by having a re-image acquisition condition modification means for changing the re-image acquisition result of the amount of bodily features with last time at the time of re-image acquisition of the above-mentioned image acquisition means.
[0007] him who specifies him from similarity with the face image of the specific person who specified beforehand which invention according to claim 2 acquires people's face image from an image acquisition means, and this face image that acquired, and a storage means memorize — it is specific equipment and it carries out having had a re-image acquisition condition modification means for changing the re-image acquisition result of a face image with last time at the time of re-image acquisition of the above-mentioned image acquisition means as the description.
[0008] Invention according to claim 3 is characterized by being the re-image acquisition condition modification means equipped with the lighting control means which carries out modification control of the quantity of light.
[0009] Invention according to claim 4 is characterized by being the re-image acquisition condition modification means equipped with the exposure-time control means which carries out modification control of the exposure time of an image acquisition means.
[0010] Invention according to claim 5 is characterized by being the re-image acquisition condition modification means equipped with the migration adjustment control means which carries out migration adjustment of at least one of a lighting control means and the image acquisition means.
[0011] the conduct into which invention according to claim 6 makes the expression of a face, and people's sense changed — it is characterized by being the re-image acquisition condition modification means equipped with the

action guidance means.

[0012] Invention according to claim 7 carries out that it is the re-image acquisition condition modification means which it had in a presumed means presume the image acquisition conditions that a modification element is most effectively obtained out of the image acquisition conditions used as the specific unknown cause that he cannot be specified, and the modification control means which carries out modification control at the image acquisition conditions presumed with this presumed means as the description.

[0013]

[Function and Effect of the Invention] According to this invention, when people's amount of bodily features is acquired from an image acquisition means, he is specified from similarity with the amount of bodily features of the specific person who specified beforehand which this acquired amount of bodily features and a storage means memorize. Under the present circumstances, when he cannot be specified, an image is again acquired from an image acquisition means with a re-image acquisition condition modification means, and at the time of acquisition of this re-image, the acquisition result of the amount of bodily features is changed with last time, and is acquired.

[0014] For this reason, it differs greatly in last time and this time, and since the image acquisition condition itself which is insufficient of the last discernment elements changes, the discernment processing image at the time of re-discernment processing can acquire the acquired amount of bodily features clearly, and a setting change is made and it is made [image] in re-discernment processing in the bottom of the image acquisition condition of having been suitable for re-discernment. Consequently, the discernment success percentage at the time of re-discernment improves, and a repetition of useless re-discernment is canceled, and compaction of the discernment processing time can be aimed at.

[0015] Moreover, the amounts of bodily features, such as with the body, may be used as a discernment element, and a clearly different face image for every individual suitable for discernment can also be used as a discernment element. Furthermore, if modification control of the quantity of light to a photographic subject is carried out by the lighting control means on the occasion of modification of the image acquisition conditions when acquiring a re-image, a setting change of his acquisition image illuminated can be made at the optimal brightness.

[0016] If modification control of the exposure time of image acquisition means, such as an image pick-up camera, is similarly carried out by the exposure-time control means on the occasion of modification of the image acquisition conditions when acquiring a re-image, a setting change can be made at the optimal brightness suitable for image acquisition.

[0017] If migration adjustment of at least one of a lighting control means and the image acquisition means is carried out by the migration adjustment control means at the upper and lower sides, right and left, rotation, etc. and a setting change of the image acquisition conditions is similarly made on the occasion of modification of the image acquisition conditions when acquiring a re-image, it differs greatly and an image acquisition include angle can acquire the image from different.

[0018] modification of the image acquisition conditions when similarly acquiring a re-image — facing — conduct — if the expression of a face and people's sense are made to be changed with an action guidance means, the image of the clearly different amount of bodily features for every individual peculiar to people will be obtained easily.

[0019] If modification control carries out in a modification control means so that it may become to the image acquisition conditions presumed the image acquisition conditions that a modification element is most effectively obtained out of the last image acquisition conditions used as the specific unknown cause that he similarly cannot be specified on the occasion of modification of the image acquisition conditions when acquiring a re-image, by the presumed means, and presumed with this presumed means, a setting change can make to the image acquisition conditions that it is most suitable to re-discernment.

[0020]

[Example] One example of this invention is explained in full detail based on a drawing below. him by whom drawing 1 applied the door of ** to management of close leaving which carries out closing-motion management — specific equipment 11 is shown, and this he specification equipment 11 installs the collating unit 15 which equipped one with the image pick-up camera 12, the ten key 13, and the card reader 14 in the face height wall surface location near the door, and the lighting light 16 and the loudspeaker 17 for changing image pick-up conditions into that wall surface upper part install, and it constitutes.

[0021] the time of setting the above-mentioned image pick-up camera 12 as the sense which picturizes the face of the person approaching a door, it acquiring face image data, and acquiring this face image data with the image pick-up camera 12 — him, such as the configuration of each part, such as eye, nose, and opening —, and the whole face, magnitude, a hairstyle, existence of glasses, a color, a wrinkle, and a makeup degree, — the face information on a proper is acquired.

[0022] And when this acquired face information was used for the specific person's 18 collating element and people approached before a door, the image pick-up camera 12 picturized people's face information, and it has set up so that it may unlock, when it collates with the registration data with which the specific person 18 registered this beforehand and a registration confirmed is carried out.

[0023] Moreover, when having set the power source of the image pick-up camera 12 as OFF, unlocking use can be carried out if he can unlock if the specific person 18 does alter operation of the personal identification number (PIN) to the ten key 13 of the collating unit 15, and he does read check of the specific person's 18 ID card to a card reader 14 in addition to the unlocking data based on an image.

[0024] drawing 2 — him — the control circuit block diagram of specific equipment 11 is shown, and a controller 21

controls each circuit apparatus in accordance with the set-up program, and memorizes the control data possible [read-out].

[0025] first, the characteristic quantity of the image which led to the discernment processing section 23 and was acquired in this discernment processing section 23 after capturing this acquired image in the image input section 22, when the image was acquired from the image pick-up camera 12 and him, the specific person who is doing the storage management in the database 24, — the characteristic quantity of a proper is made to measure and a collating check is carried out.

[0026] When it judges with the ability of his discernment not to be correctly performed from the acquired image at this time, an output control is carried out so that this controller 21 may acquire an image repeatedly. In this case, the controller 21 has the image acquisition condition modification function to make image acquisition conditions change in order to acquire the image suitable for re-discernment.

[0027] They connect the camera control section 25, the lighting control section 26, and the voice output section 27 possible [remote control] from a controller 21, respectively, and by controlling at least one from this controller 21, these image acquisition condition modification functions differ greatly, and thereby, the acquisition conditions of the amount of bodily features change image acquisition data with last time, and acquire them.

[0028] For example, when controlling the camera control section 25, the exposure time of the image pick-up camera 12 is changed, and the brightness of a photographic subject is changed. At this time, a setting change can be made at the optimal brightness suitable for image acquisition of the amount of bodily features.

[0029] Moreover, the upper and lower sides, right and left, rotation, etc. carry out migration adjustment of the image pick-up camera 12, an image pickup position and an image acquisition include angle are changed, and an image is acquired from different. At this time, the last image acquisition condition itself the acquired images certainly differ in last time and this time, and are insufficient for of a discernment element is improved, and the specific person's 18 amount of bodily features can be acquired clearly.

[0030] When controlling the lighting control section 26, the quantity of light of the lighting light 16 is changed. At this time, a setting change can be made at the brightness which changed the brightness of the whole circumference and was suitable for image acquisition of a photographic subject.

[0031] Moreover, the upper and lower sides, right and left, etc. carry out migration adjustment of the lighting light 16, a lighting location and a lighting include angle are changed, and an image is acquired. In this case, the image acquisition condition itself changes a lot compared with last time, consequently the specific person's 18 amount of bodily features can be acquired clearly.

[0032] the conduct of a man, such as changing the expression of a face, and people's sense, when controlling the voice output section 27, — voice guidance is carried out so that an action may be made to be changed from a loudspeaker 17. In this case, the image which a different discernment element peculiar to him for every individual was obtained, consequently clarified the specific person's 18 amount of bodily features is obtained.

[0033] In addition, as an image acquisition condition modification function, a controller 21 presumes the image acquisition conditions that a modification element is obtained most effectively out of the last image acquisition conditions used as a specific unknown cause, and it carries out modification control of one of the camera control section 25, the lighting control section 26, and the voice output sections 27, or its plurality so that it may become this presumed image acquisition condition.

[0034] for example, when extracting characteristic quantity from image data, make the constant-rate migration of the image pick-up camera 12 carry out in the correction direction, constant-rate migration adjustment of the lighting light 16 is carried out in the correction direction, or the expression of a face and people's sense are made to be changed from a loudspeaker 17 based on various discernment elements, such as a concentration difference of an acquisition image, sense of a face, and an inclination degree, — as — conduct — what is necessary is just to carry out voice guidance of the action A setting change can be made by this at the image acquisition conditions of having been most suitable for re-discernment, and a re-image can be acquired.

[0035] By using such an image acquisition condition modification function, a repetition of the useless re-discernment by repeating and acquiring the image which discernment success percentage improves since the image of the amount of bodily features suitable for the discernment at the time of re-discernment is certainly acquirable, and is approximated at the time of re-discernment is canceled, and compaction of the discernment processing time can be planned.

[0036] By the way, whenever it registers into the database 24 the characteristic quantity of the face of the specific person proper specified beforehand, it uses this for collating check data and it acquires face information with the image pick-up camera 12, comparison collating of the characteristic quantity of the face is carried out, and it judges whether you are him.

[0037] drawing 3 — him — similarity judging processing actuation of specific equipment is shown, and the raw image which acquired face information from the image pick-up camera 12 is once accumulated in an image memory 31. A face field is searched with the face detecting element 32 from this accumulated raw image, and the picturized face field is detected. the background which detects a face and the outline of the circumference of it and extracts the difference of 1. background image and an acquisition image on the occasion of the detection technique of this face field here — difference — the beige detection technique 3. optical flow and the frame using a technique 2. color — a face field is detected using either of the technique of moving and asking for detection technique 4. face-likeness with a neural network or pattern matching using difference.

[0038] After detecting this face field, matching detects the location of a face correctly by the face location

detecting element 33 based on the description models, such as eye, nose, and opening —. If the location of a face is detected correctly and positioned, the face characteristic quantity started from the face image in the face feature-extraction section 34 will be extracted. This face characteristic quantity extracts a difference with an average face using statistical methods, such as principal component analysis, or extracts it from shade images, such as eye, nose, and opening —, by template matching. Comparison collating of this extracted face characteristic quantity and the description memory beforehand registered into the database 24 is carried out in the similarity judging section 35, and the similarity of face information is judged.

[0039] In this case, the controller 21 has set up SURESSHORUDAREBERU used as the decision criterion for specifying him, computes the similarity value when collating the characteristic quantity of a face and the characteristic quantity of registration data which were calculated from the inputted image data, if this value is higher than SURESSHORUDAREBERU, it specifies it with him, and if low, it will be judged to be others or a non-registrant.

[0040] thus, him who was constituted — it explains with reference to the flow chart which shows discernment processing actuation of specific equipment 11 to drawing 4 . If the location of a face is detected correctly and positioned from the descriptions, such as eye, nose, and opening —, after searching a face field from that image data, detecting the picturized face field (step n1 −n2) and detecting this face field, if the image data of a face is now acquired from the image pick-up camera 12, face characteristic quantity will be extracted from this face image (step n3 −n4).

[0041] Comparison collating of this extracted face characteristic quantity and the characteristic quantity registered beforehand is carried out, and it asks for similarity (step n5 −n6), when similarity is more than SURESSHORUDAREBERU, it accepts as a specific person, and discernment processing is completed (step n7).

[0042] By the way, the image acquisition conditions when picturizing with the image pick-up camera 12, when face characteristic quantity is extracted from a face image, the lighting conditions when illuminating in the lighting light 16, and a loudspeaker 17 — conduct, when voice guidance of the action is carried out, and the voice guidance condition is incorporated as a parameter of discernment conditions (step n8) and it is judged with a discernment error The parameter with which the controller 21 fitted re-discernment is chosen, a controller 21 makes a setting change and the conditions of this selected parameter are re-identified (step n9 −n10).

[0043] For example, as shown in drawing 5 , when the error for the input image of a face which inclined at the time of the 1st image acquisition which is not discriminable occurs It judges with the parameter with which it becomes the image acquisition conditions most effective when re-identifying to carry out migration adjustment of the image pick-up camera 12 so that the image of the transverse-plane face of normal may be obtained, and based on this, a controller 21 performs re-discernment processing so that the sense of the image pick-up camera 12 may be corrected and a transverse-plane face can be obtained. At the time of the 2nd image acquisition, the input image near a transverse-plane face is acquirable by this, and by acquiring the image of this transverse-plane face, a discernment probability increases, and a specific person can be distinguished clearly and can be identified.

[0044] Moreover, as shown in drawing 6 , when the error for the input image with which the left half of a face became dark at the time of the 1st image acquisition which is not discriminable occurs Carrying out migration adjustment of the lighting light 16 so that the uniform lighting of normal may be obtained When re-identifying, it judges with the parameter used as the most effective image acquisition conditions, and based on this, a controller 21 performs re-discernment processing so that the sense of the lighting light 16 may be corrected and uniform lighting may be obtained. At the time of the 2nd image acquisition, the input image of uniform brightness suitable for the judgment of discernment can be acquired by this, and a discernment probability increases by acquiring the image of this suitable brightness. Therefore, a specific person is certainly discriminable in several discernment processing actuation.

[0045] As mentioned above, since re-image acquisition conditions are changed and acquired so that the image acquisition data of the amount of bodily features may differ from last time at the time of re-image acquisition, it differs greatly in last time and this time, and the image acquisition condition itself which is insufficient of the last discernment elements is improved, and the discernment processing image at the time of re-discernment processing clarifies the amount of bodily features, and can acquire it. Consequently, the discernment success percentage at the time of re-discernment improves, and a repetition of useless re-discernment is canceled, and compaction of the discernment processing time can be aimed at. Moreover, a clearly different face image for every individual suitable for discernment is used as a discernment element, and also the amounts of bodily features, such as with the body, can also be used as a discernment element.

[0046] In correspondence with this invention and the configuration of one above-mentioned example the image acquisition means of this invention It corresponds to the image pick-up camera 12 of an example. Like the following a storage means It corresponds to a database 24. An image acquisition condition modification means, a presumed means, and a modification control means It corresponds to a controller 21. A lighting control means It corresponds to the lighting light 16 and the lighting control section 26. An exposure-time control means the image pick-up camera 12 and the camera control section 25 — corresponding — conduct — ** corresponding to a loudspeaker 17 and the voice output section 27 and this invention can apply an action guidance means based on the technical thought shown in a claim, and it is not limited only to the configuration of one above-mentioned example.
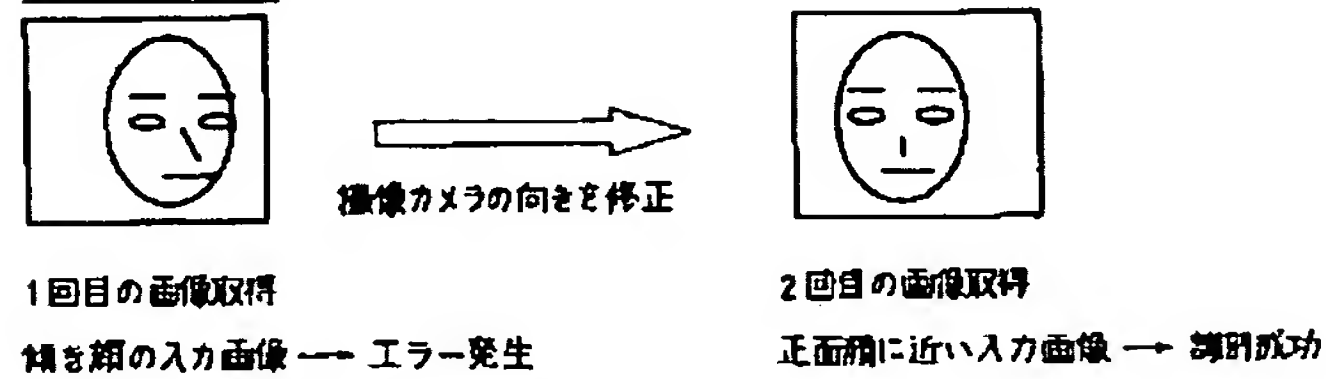
[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
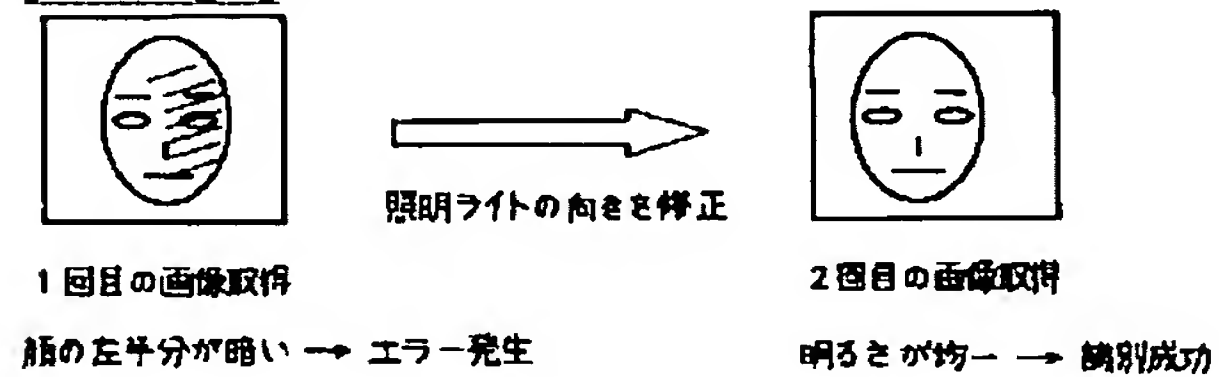damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

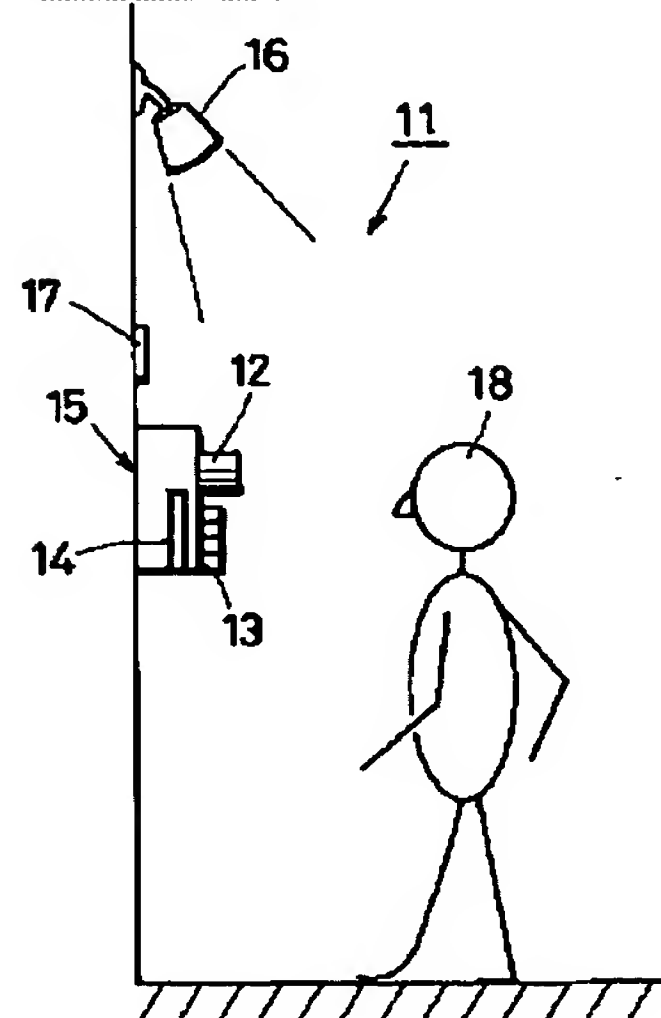DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] him of this invention — the outline side elevation showing the busy condition of specific equipment.
[Drawing 2] him of this invention — the control circuit block diagram of specific equipment.
[Drawing 3] him of this invention — the explanatory view showing similarity judging processing actuation of the face information on specific equipment.
[Drawing 4] him of this invention — the flow chart which shows discernment processing actuation of specific equipment.
[Drawing 5] The explanatory view showing the image acquisition condition modification actuation which corrected the sense of the image pick-up camera of this invention.
[Drawing 6] The explanatory view showing the image acquisition condition modification actuation which corrected the sense of the lighting light of this invention.
[Description of Notations]
11 — He specification equipment
12 — Image pick-up camera
16 — Lighting light
17 — Loudspeaker
18 — Specific person
21 — Controller
22 — Image input section
23 — Discernment processing section
24 — Database
25 — Camera control section
26 — Lighting control section
27 — Voice output section

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.
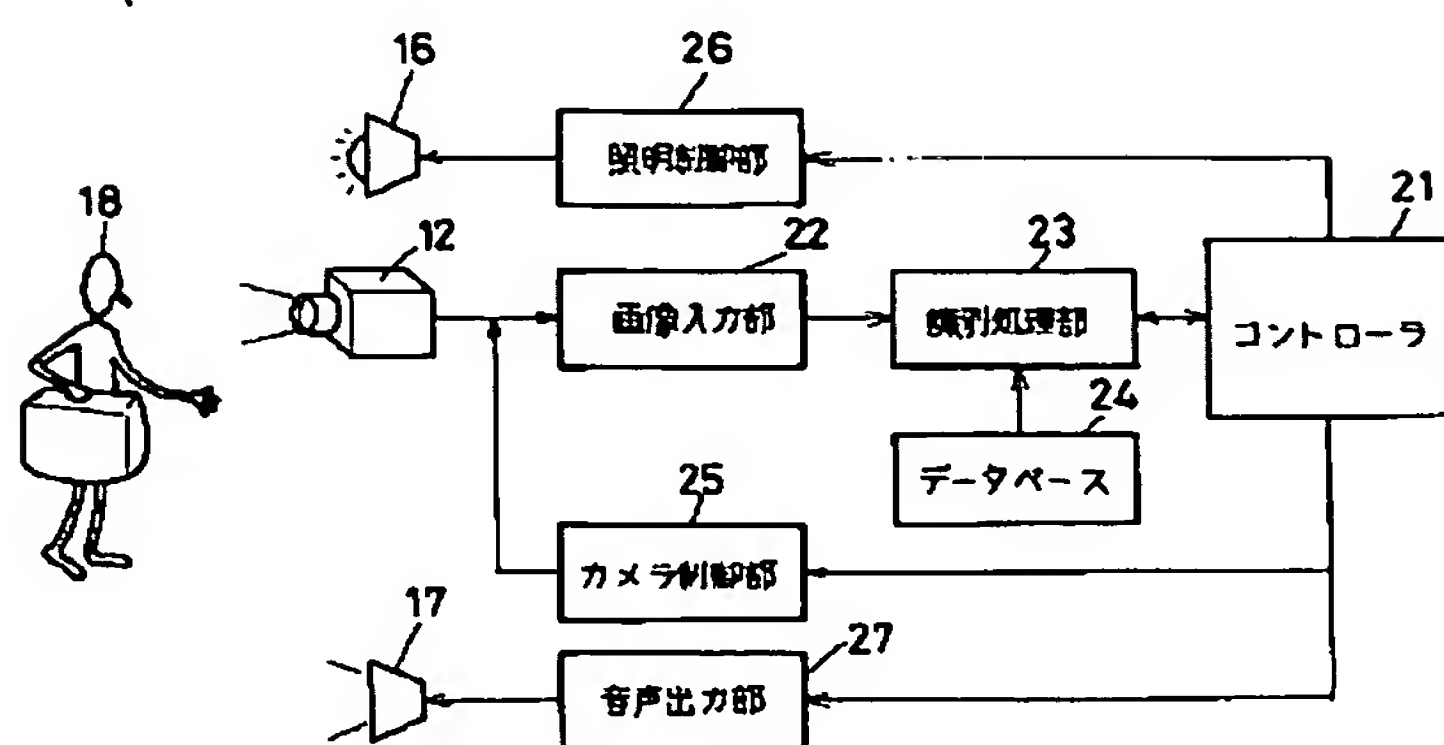

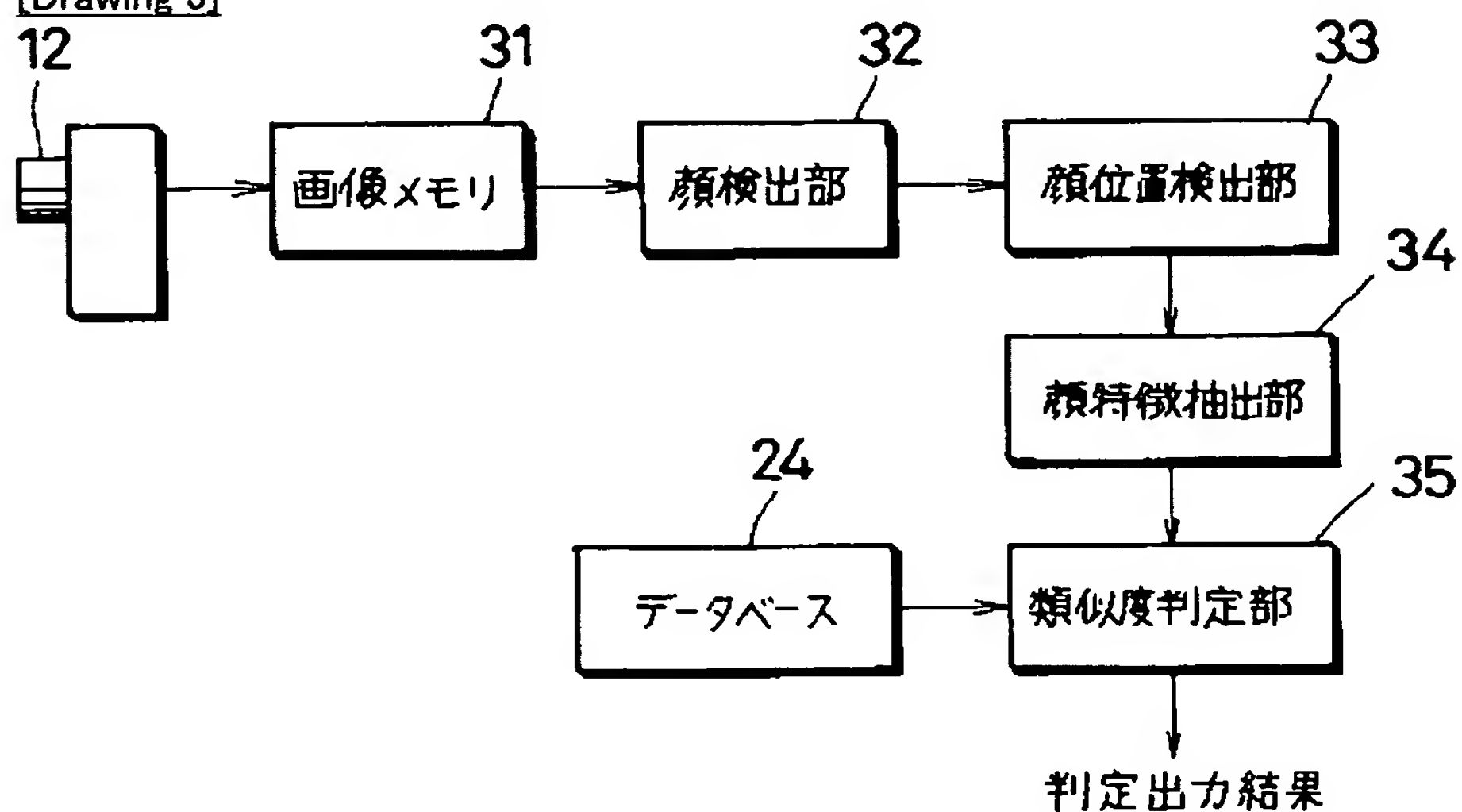
DRAWINGS

[Drawing 5]

[Drawing 6]

[Drawing 1]

[Drawing 2]

12…撮像カメラ　　17…スピーカ
16…照明ライト　　18…特定者

[Drawing 3]

12 … 撮像カメラ

[Drawing 4]

識別開始

n1　画像データ入力

n2　顔領域検出

n3　顔位置検出

n4　顔特徴量計算

n8　パラメータ推定

n6　登録特徴量

n5　類似度計算

n9　画像入力制御

n7　類似度 >スレッショルドレベル ?

NO

n10　識別エラー

YES

識別終了

[Translation done.]

(51)Int.Cl.⁶	識別記号	F I	
G 0 6 T	7/00	G 0 6 F　15/62	4 6 5 K

(54)【発明の名称】　本人特定装置

(57)【要約】

【課題】この発明は、本人の特定に伴って再識別処理するとき、この再識別処理に適した画像取得条件に設定変更して特定者を確実に識別できるようにした本人特定装置の提供を目的とする。

【解決手段】この発明は、人の身体的特徴量を画像取得手段より取得し、この取得した身体的特徴量と記憶手段が記憶する予め特定した特定者の身体的特徴量との類似度から本人を特定する本人特定装置であって、上記画像取得手段の再画像取得時に、身体的特徴量の再画像取得結果を前回と異ならせるための再画像取得条件変更手段を備えたことを特徴とする。

1

【特許請求の範囲】
【請求項１】人の身体的特徴量を画像取得手段より取得し、この取得した身体的特徴量と記憶手段が記憶する予め特定した特定者の身体的特徴量との類似度から本人を特定する本人特定装置であって、上記画像取得手段の再画像取得時に、身体的特徴量の再画像取得結果を前回と異ならせるための再画像取得条件変更手段を備えた本人特定装置。

【請求項２】人の顔画像を画像取得手段より取得し、この取得した顔画像と記憶手段が記憶する予め特定した特定者の顔画像との類似度から本人を特定する本人特定装置であって、上記画像取得手段の再画像取得時に、顔画像の再画像取得結果を前回と異ならせるための再画像取得条件変更手段を備えた本人特定装置。

【請求項３】再画像取得条件変更手段は、光量を変更制御する照明制御手段であることを特徴とする請求項１または２記載の本人特定装置。

【請求項４】再画像取得条件変更手段は、画像取得手段の露光時間を変更制御する露光時間制御手段であることを特徴とする請求項１または２記載の本人特定装置。

【請求項５】再画像取得条件変更手段は、照明制御手段、画像取得手段の少なくとも一つを移動調整する移動調整制御手段であることを特徴とする請求項１、２または３記載の本人特定装置。

【請求項６】再画像取得条件変更手段は、顔の表情や人の向きを変えさせる所作行為案内手段を備えたことを特徴とする請求項１または２記載の本人特定装置。

【請求項７】　再画像取得条件変更手段は、本人を特定できない特定不明原因となった画像取得条件の中から最も有効に変更要素が得られる画像取得条件を推定する推定手段と、上記推定手段で推定した画像取得条件に変更制御する変更制御手段とを備えた請求項１または２記載の本人特定装置。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】この発明は、人の身体的特徴量を照合要素に用いて識別する本人特定装置に関し、さらに詳しくは１回で正しく本人を識別できない特定不能時に繰返し実行する再特定処理時の特定成功率を高めた本人特定装置に関する。

【０００２】
【従来の技術】一般に、この種の本人特定装置は歩いて来る人の顔を撮像カメラで撮影し、これをリアルタイムで識別したり、機器の前に立止まっている人を撮影して識別する識別機能が備えられている。この識別に際しては、顔画像から特徴量を抽出し、この抽出した特徴量と登録データとを比較して類似度を求めることにより本人か否かを識別している。

【０００３】このとき、正しく本人を識別できない場合は、識別手順を繰返して再識別処理を実行している。こ

2

の場合、１回の識別処理で本人を正しく識別する確率は、例えば９０％の識別成功率を有していれば、

$$1-(1-0.9)N$$

となり、例えば再識別処理回数Ｎ＝３としても、識別成功率は９９．９９％となる。このように、１回あたりの識別成功率が低くても計算上では再識別処理回数を増やせば、識別成功率は大幅に向上することになる。

【０００４】しかし、実際は再識別処理の識別処理画像が全く同じ画像であり、それが１回目にエラーになったものであれば、何度繰返しても成功することはなく、同様に再識別する識別処理画像が例え時間的に数フレーム異なっていたとしても、顔像に視覚的に大きな違いはなく、繰返し再識別処理しても成功しないことが多い。特に、入力画像の明るさが適切でなかったり、顔画像の陰影が過剰になっていたり、顔の向きが識別に不向きな場合は、何度再識別しても良い結果は得られず、識別エラーとなってしまうことが多い。

【０００５】
【発明が解決しようとする課題】そこでこの発明は、本人の特定に伴って再識別処理するとき、この再識別処理に適した画像取得条件に設定変更して特定者を確実に識別できるようにした本人特定装置の提供を目的とする。

【０００６】
【課題を解決するための手段】請求項１記載の発明は、人の身体的特徴量を画像取得手段より取得し、この取得した身体的特徴量と記憶手段が記憶する予め特定した特定者の身体的特徴量との類似度から本人を特定する本人特定装置であって、上記画像取得手段の再画像取得時に、身体的特徴量の再画像取得結果を前回と異ならせるための再画像取得条件変更手段を備えたことを特徴とする。

【０００７】請求項２記載の発明は、人の顔画像を画像取得手段より取得し、この取得した顔画像と記憶手段が記憶する予め特定した特定者の顔画像との類似度から本人を特定する本人特定装置であって、上記画像取得手段の再画像取得時に、顔画像の再画像取得結果を前回と異ならせるための再画像取得条件変更手段を備えたことを特徴とする。

【０００８】請求項３記載の発明は、光量を変更制御する照明制御手段を備えた再画像取得条件変更手段であることを特徴とする。

【０００９】請求項４記載の発明は、画像取得手段の露光時間を変更制御する露光時間制御手段を備えた再画像取得条件変更手段であることを特徴とする。

【００１０】請求項５記載の発明は、照明制御手段、画像取得手段の少なくとも一つを移動調整する移動調整制御手段を備えた再画像取得条件変更手段であることを特徴とする。

【００１１】請求項６記載の発明は、顔の表情や人の向きを変えさせる所作行為案内手段を備えた再画像取得条

3

件変更手段であることを特徴とする。

【００１２】請求項７記載の発明は、本人を特定できない特定不明原因となった画像取得条件の中から最も有効に変更要素が得られる画像取得条件を推定する推定手段と、この推定手段で推定した画像取得条件に変更制御する変更制御手段とを備えた再画像取得条件変更手段であることを特徴とする。

【００１３】

【発明の作用及び効果】この発明によれば、人の身体的特徴量を画像取得手段より取得したとき、この取得した身体的特徴量と記憶手段が記憶する予め特定した特定者の身体的特徴量との類似度から本人を特定する。この際、本人を特定できないときは、再画像取得条件変更手段により再度、画像取得手段より画像を取得し、この再画像の取得時に身体的特徴量の取得結果を前回と異ならせて取得する。

【００１４】このため、再識別処理時の識別処理画像は前回と今回とで大きく異なり、前回の識別要素が不足していた画像取得条件そのものが変化するため、取得した身体的特徴量を明確に取得でき、再識別に適した画像取得条件下に設定変更して再識別処理ができる。この結果、再識別時の識別成功率が向上し、また無駄な再識別の繰返しが解消されて識別処理時間の短縮が図れる。

【００１５】また、身体付きなど身体的特徴量を識別要素にしてもよく、識別に適した個人毎に明瞭に異なる顔画像を識別要素にすることもできる。さらに、再画像を取得するときの画像取得条件の変更に際して、照明制御手段により被写体に対する光量を変更制御すれば、照明される本人の取得画像を最適な明るさに設定変更することができる。

【００１６】同じく、再画像を取得するときの画像取得条件の変更に際して、露光時間制御手段により撮像カメラ等の画像取得手段の露光時間を変更制御すれば、画像取得に適した最適な明るさに設定変更することができる。

【００１７】同じく、再画像を取得するときの画像取得条件の変更に際して、移動調整制御手段により照明制御手段、画像取得手段の少なくとも一つを上下、左右、回転等に移動調整して画像取得条件を設定変更すれば、画像取得角度が大きく異なり、異方向からの画像を取得することができる。

【００１８】同じく、再画像を取得するときの画像取得条件の変更に際して、所作行為案内手段により顔の表情や人の向きを変えさせれば、人特有の個人毎に明確に異なる身体的特徴量の画像が容易に得られる。

【００１９】同じく、再画像を取得するときの画像取得条件の変更に際して、本人を特定できない特定不明原因となった前回の画像取得条件の中から最も有効に変更要素が得られる画像取得条件を推定手段により推定し、この推定手段で推定した画像取得条件になるように変更制御

4

御手段を変更制御すれば、再識別に最も適した画像取得条件に設定変更することができる。

【００２０】

【実施例】この発明の一実施例を以下図面に基づいて詳述する。図１は室の扉を開閉管理する入退室の管理に適用した本人特定装置１１を示し、この本人特定装置１１は撮像カメラ１２と、テンキー１３と、カードリーダ１４とを一体に備えた照合ユニット１５を扉近傍の顔高さ壁面位置に設置し、またその壁面上部には撮像条件を変えるための照明ライト１６とスピーカ１７を設置して構成している。

【００２１】上述の撮像カメラ１２は、扉に近付いた人の顔を撮像する向きに設定して顔画像データを取得し、この顔画像データを撮像カメラ１２で取得する際、目、鼻、口…等の各部分および顔全体の形状や大きさ、髪型、眼鏡の有無、色、皺、化粧度合い等の本人固有の顔情報を取得する。

【００２２】そして、この取得した顔情報を特定者１８の照合要素に用い、扉の前に人が近付いたとき、撮像カメラ１２が人の顔情報を撮像し、これを特定者１８の予め登録した登録データと照合して登録確認したとき解錠するように設定している。

【００２３】また、撮像カメラ１２の電源をＯＦＦに設定しているときは、画像による解錠データ以外に、特定者１８が照合ユニット１５のテンキー１３に暗証番号（ＰＩＮ）を入力操作すれば解錠することができ、またカードリーダ１４に特定者１８のＩＤカードを読取りチェックさせれば解錠利用することができる。

【００２４】図２は本人特定装置１１の制御回路ブロック図を示し、コントローラ２１は設定されたプログラムに沿って各回路装置を制御し、その制御データを読出し可能に記憶する。

【００２５】先ず、撮像カメラ１２から画像を取得すると、この取得した画像を画像入力部２２に取込んだ後、識別処理部２３に導いて、この識別処理部２３で取得した画像の特徴量と、データベース２４で記憶管理している特定者の本人固有の特徴量とを比較させて照合確認する。

【００２６】このとき、取得した画像から正しく本人の識別ができないと判定した場合は、このコントローラ２１が繰返し画像を取得するように出力制御する。この場合、コントローラ２１は再識別に適した画像を取得するため、画像取得条件を変更させる画像取得条件変更機能を有している。

【００２７】この画像取得条件変更機能は、コントローラ２１から遠隔制御可能にカメラ制御部２５、照明制御部２６、音声出力部２７をそれぞれ接続し、このコントローラ２１から少なくとも１つを制御することにより身体的特徴量の取得条件が大きく異なり、これにより画像取得データを前回と異ならせて取得する。

【００２８】例えば、カメラ制御部２５を制御する場合、撮像カメラ１２の露光時間を変えて被写体の明るさを変更する。このときは、身体的特徴量の画像取得に適した最適な明るさに設定変更することができる。

【００２９】また、撮像カメラ１２を上下、左右、回転など移動調整して撮像位置や画像取得角度を変えて異方向から画像を取得する。このときは、取得した画像が前回と今回とで確実に異なり、識別要素が不足していた前回の画像取得条件そのものが改善されて特定者１８の身体的特徴量を明確に取得できる。

【００３０】照明制御部２６を制御する場合は、照明ライト１６の光量を変更する。このときは、周辺全体の明るさを変えて被写体の画像取得に適した明るさに設定変更することができる。

【００３１】また、照明ライト１６を上下、左右など移動調整して照明位置や照明角度を変えて画像を取得する。この場合は、画像取得条件そのものが前回に比べて大きく変化し、この結果、特定者１８の身体的特徴量を明確に取得できる。

【００３２】音声出力部２７を制御する場合は、顔の表情や人の向きを変えるなど人の所作行為を変えさせるようにスピーカ１７より音声案内する。この場合は、個人毎に異なる本人特有の識別要素が得られ、この結果、特定者１８の身体的特徴量を明確にした画像が得られる。

【００３３】この他、画像取得条件変更機能としてコントローラ２１は、特定不明原因となった前回の画像取得条件の中から最も有効に変更要素が得られる画像取得条件を推定し、この推定した画像取得条件になるようにカメラ制御部２５、照明制御部２６、音声出力部２７の一つ、あるいはその複数を変更制御する。

【００３４】例えば、画像データから特徴量を抽出するときに、取得画像の濃度差、顔の向き、傾き度合い等の様々な識別要素に基づいて、撮像カメラ１２を修正方向に一定量移動させたり、照明ライト１６を修正方向に一定量移動調整したり、スピーカ１７より顔の表情や人の向きを変えさせるように所作行為を音声案内させればよい。これにより、再識別に最も適した画像取得条件に設定変更して再画像を取得することができる。

【００３５】このような画像取得条件変更機能を働かせることにより、再識別時の識別に適した身体的特徴量の画像を確実に取得することができるため識別成功率が向上し、また再識別時に近似する画像を繰返し取得することによる無駄な再識別の繰返しが解消されて識別処理時間の短縮を図ることができる。

【００３６】ところで、データベース２４には予め特定した特定者固有の顔の特徴量を登録しておき、これを照合確認データに用い、撮像カメラ１２で顔情報を取得する毎に、その顔の特徴量を比較照合して本人か否かを判定する。

【００３７】図３は本人特定装置の類似度判定処理動作

を示し、撮像カメラ１２から顔情報を取得した生画像を一旦画像メモリ３１に蓄積する。この蓄積した生画像から顔検出部３２で顔領域の検索を行って、撮像した顔領域を検出する。ここでは、顔とその周辺の概略を検出し、この顔領域の検出手法に際しては、

１．背景画像と取得画像の差を抽出する背景差分手法

２．カラーを用いた肌色検出手法

３．オプチカルフローやフレーム差分を用いた動き検出手法

４．顔らしさをニューラルネットワークやパターンマッチングによって求める手法

のいずれかを用いて顔領域を検出する。

【００３８】この顔領域を検出した後、顔位置検出部３３で目、鼻、口…等の特徴モデルを元にマッチングによって顔の位置を正確に検出する。顔の位置を正確に検出して位置決めすると、顔特徴抽出部３４で顔画像から切出された顔特徴量を抽出する。この顔特徴量は平均顔との差を主成分分析等の統計的手法を用いて抽出するか、あるいは目、鼻、口…等の濃淡画像からテンプレートマッチングにより抽出する。この抽出された顔特徴量と、データベース２４に予め登録された特徴メモリとを類似度判定部３５で比較照合して顔情報の類似度を判定する。

【００３９】この場合、コントローラ２１は本人を特定するための判断基準となるスレッショルダレベルを設定しており、入力された画像データから求めた顔の特徴量と登録データの特徴量とを照合したときの類似度値を算出し、この値がスレッショルダレベルより高ければ本人と特定し、低ければ他人あるいは未登録者と判定する。

【００４０】このように構成された本人特定装置１１の識別処理動作を図４に示すフローチャートを参照して説明する。　　今、撮像カメラ１２から顔の画像データを取得すると、その画像データから顔領域の検索を行って、撮像した顔領域を検出し（ステップｎ１〜ｎ２）、この顔領域を検出した後、目、鼻、口…等の特徴から顔の位置を正確に検出して位置決めすると、この顔画像から顔特徴量を抽出する（ステップｎ３〜ｎ４）。

【００４１】この抽出された顔特徴量と、予め登録された特徴量とを比較照合して類似度を求め（ステップｎ５〜ｎ６）、類似度がスレッショルダレベル以上のときは特定者と認めて、識別処理が終了する（ステップｎ７）。

【００４２】ところで、顔画像から顔特徴量を抽出したとき、撮像カメラ１２で撮像したときの画像取得条件、照明ライト１６で照明したときの照明条件、スピーカ１７で所作行為を音声案内した場合はその音声案内条件を、識別条件のパラメータとして取込み（ステップｎ８）、識別エラーと判定されたときに、コントローラ２１が再識別に適したパラメータを選択し、この選択したパラメータの条件をコントローラ２１が設定変更して再
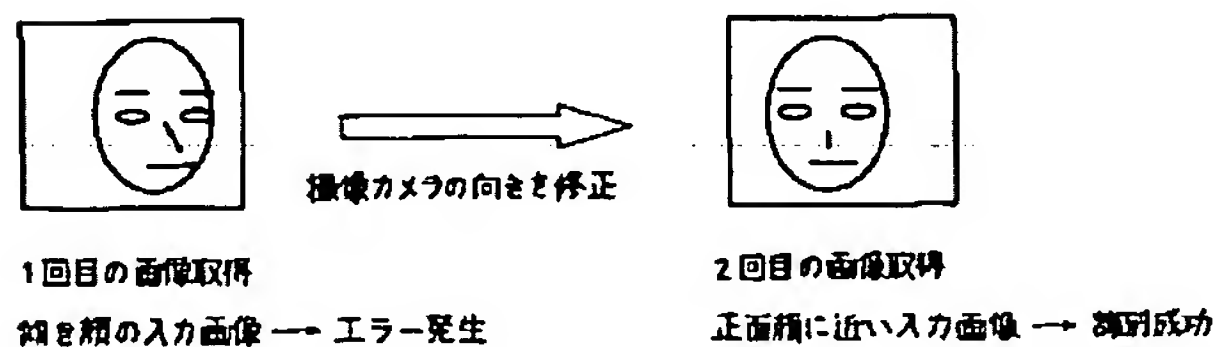
7　　　　　　　　　　　　　　　　　　　　　　　　8

識別する（ステップn9〜n10）。

【0043】例えば、図5に示すように、1回目の画像取得時に、傾いた顔の入力画像のために識別不能なエラーが発生した場合は、正規の正面顔の画像が得られるように撮像カメラ12を移動調整することが、再識別するときに最も有効な画像取得条件となるパラメータと判定し、これに基づいてコントローラ21は撮像カメラ12の向きを修正して正面顔を得られるように再識別処理を実行する。これにより、2回目の画像取得時には正面顔に近い入力画像を取得することができ、この正面顔の画像を取得することによって識別確率が高まり、特定者を明確に区別して識別することができる。

【0044】また、図6に示すように、1回目の画像取得時に、顔の左半分が暗くなった入力画像のために識別不能なエラーが発生した場合は、正規の均一な照明が得られるように照明ライト16を移動調整することが、再識別するときに最も有効な画像取得条件となるパラメータと判定し、これに基づいてコントローラ21は照明ライト16の向きを修正して均一な照明が得られるように再識別処理を実行する。これにより、2回目の画像取得時には識別の判定に適した均一な明るさの入力画像を取得することができ、この適切な明るさの画像を取得することによって識別確率が高まる。従って、数回の識別処理動作で特定者を確実に識別することができる。
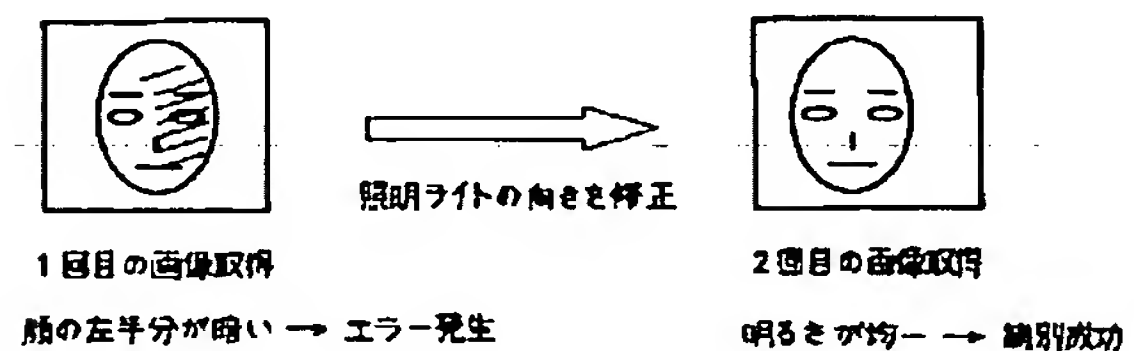
【0045】上述のように、再画像取得時には身体的特徴量の画像取得データが前回と異なるように再画像取得条件を変更して取得するため、再識別処理時の識別処理画像は前回と今回とで大きく異なり、前回の識別要素が不足していた画像取得条件そのものが改善されて身体的特徴量を明確にして取得できる。この結果、再識別時の識別成功率が向上し、また無駄な再識別の繰返しが解消されて識別処理時間の短縮が図れる。また、識別に適した個人毎に明瞭に異なる顔画像を識別要素にする他、身体付きなど身体的特徴量を識別要素にすることもできる。

【0046】この発明と、上述の一実施例の構成との対＊

＊応において、この発明の画像取得手段は、実施例の撮像カメラ12に対応し、以下同様に、記憶手段は、データベース24に対応し、画像取得条件変更手段、推定手段及び変更制御手段は、コントローラ21に対応し、照明制御手段は、照明ライト16及び照明制御部26に対応し、露光時間制御手段は、撮像カメラ12及びカメラ制御部25に対応し、所作行為案内手段は、スピーカ17及び音声出力部27に対応するも、この発明は、請求項に示される技術思想に基づいて応用することができ、上述の一実施例の構成のみに限定されるものではない。

【図面の簡単な説明】

【図1】　　この発明の本人特定装置の使用状態を示す概略側面図。

【図2】　　この発明の本人特定装置の制御回路ブロック図。

【図3】　　この発明の本人特定装置の顔情報の類似度判定処理動作を示す説明図。
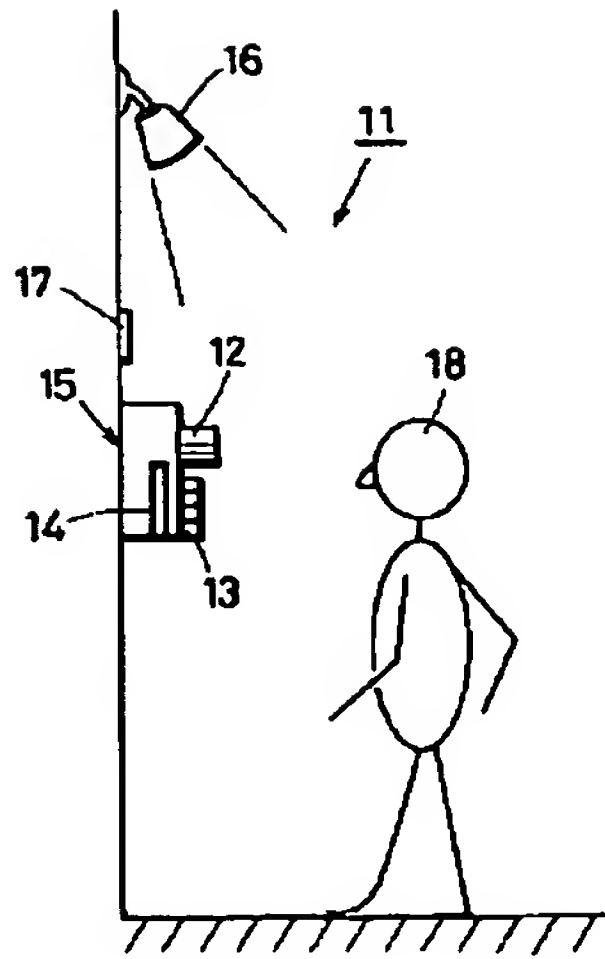
【図4】　　この発明の本人特定装置の識別処理動作を示すフローチャート。

【図5】　　この発明の撮像カメラの向きを修正した画像取得条件変更動作を示す説明図。
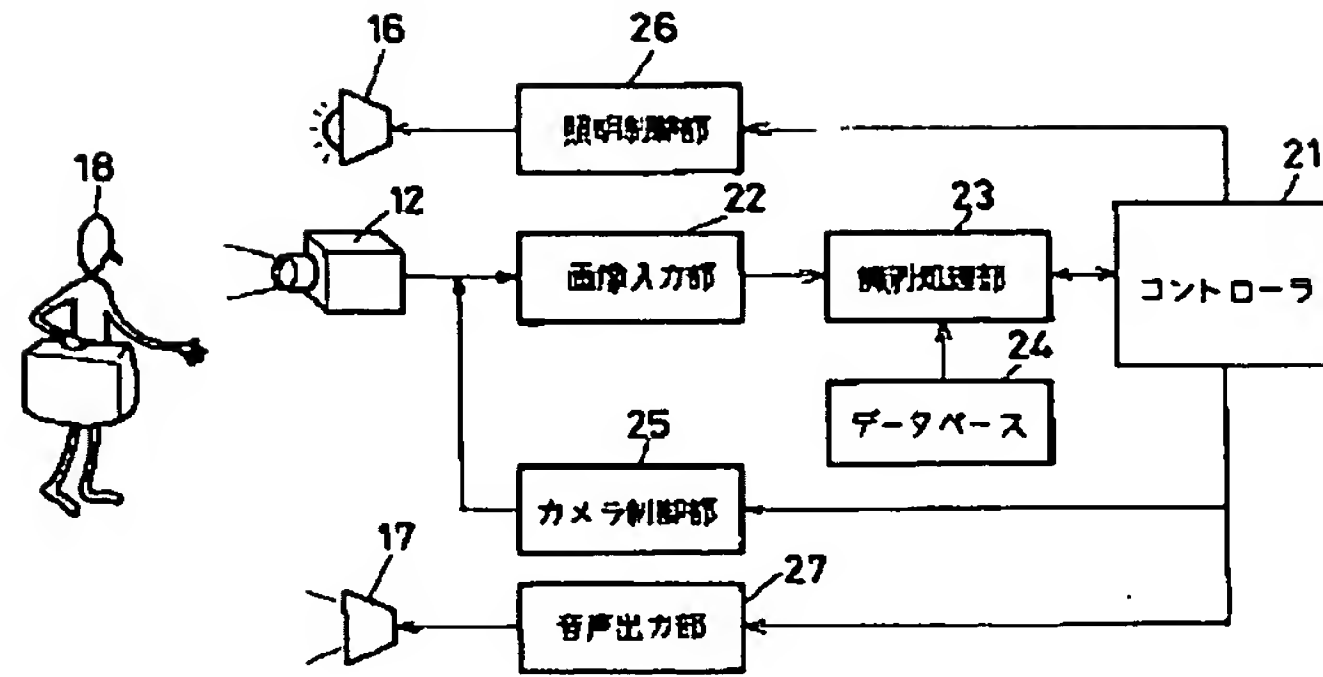
【図6】　　この発明の照明ライトの向きを修正した画像取得条件変更動作を示す説明図。

【符号の説明】

11…本人特定装置
12…撮像カメラ
16…照明ライト
17…スピーカ
18…特定者
21…コントローラ
22…画像入力部
23…識別処理部
24…データベース
25…カメラ制御部
26…照明制御部
27…音声出力部

【図5】

1回目の画像取得　　　　撮像カメラの向きを修正　　　　2回目の画像取得
傾き顔の入力画像 ━━ エラー発生　　　　正面顔に近い入力画像 ━━ 識別成功

【図6】

1回目の画像取得　　　　照明ライトの向きを修正　　　　2回目の画像取得
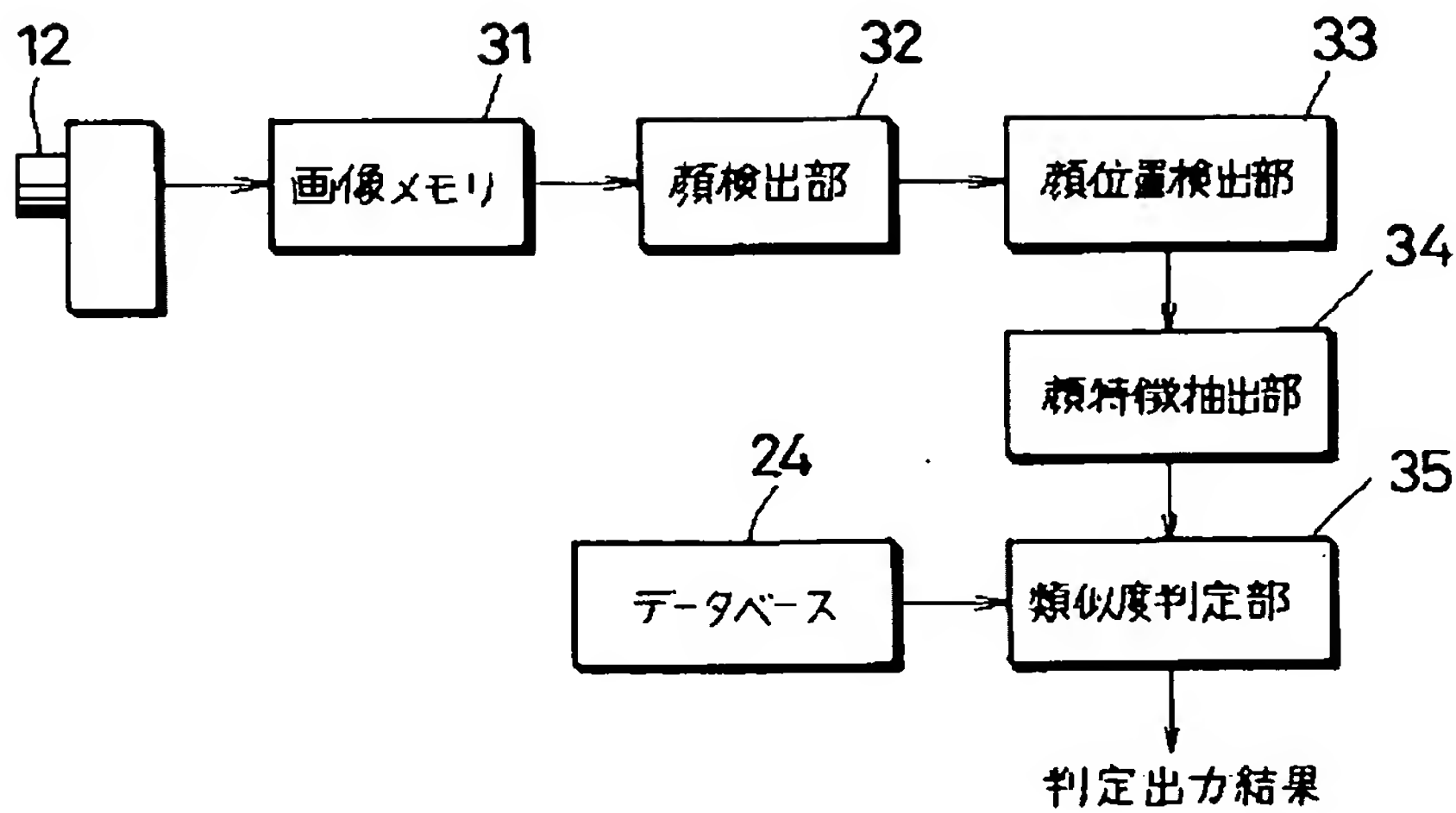顔の左半分が暗い ━━ エラー発生　　　　明るさが均一 ━━ 識別成功

【図1】

11 … 本人特定装置　17 … スピーカ
12 … 撮像カメラ　　18 … 特定者
16 … 照明ライト

【図2】

12 … 撮像カメラ　　17 … スピーカ
16 … 照明ライト　　18 … 特定者

【図3】

判定出力結果

12 … 撮像カメラ

【図4】